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Intergenerational Transmission of Inflation Aversion: Theory and Evidence

by

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IRISS Working Paper Series 2009-11 September 2009

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Reference IRISS Working Paper 2009-11, CEPS/INSTEAD, Differdange, Luxembourg

URL http://ideas.repec.org/p/irs/iriswp/2009-11.html

(CEPS/INSTEAD internal doc. #07-09-0485-E)

Intergenerational Transmission of Inflation Aversion: Theory and Evidence*

Etienne Farvaque† and Alexander Mihailov‡

Abstract

This paper studies the transmission of preferences in an overlapping-generations model with heterogeneous mature agents characterized by different degrees of inflation aversion. We show how the dynamics of a society's degree of inflation aversion and the implied degree of central bank independence depend on the direction and speed of changes in the structure of the population's preferences, themselves a function of parent socialization efforts in response to observed inflation. We then construct a survey-based measure of inflation aversion and provide empirical support for our analytical and simulation results. Available cross-section evidence confirms that a nation's demographic structure, in particular variation in the share of retirees as a proxy for the more inflation-averse type, is a key determinant of inflation aversion, together with experience with past inflation and the resulting collective memory embodied in monetary institutions.

Keywords: intergenerational transmission, evolving preferences, inflation aversion, central bank independence, collective memory

JEL classification: D72, D83, E31, E58, H41, J10

*This is a revised version (August 2009) of Economics and Management Discussion Paper 08-071 (August 2008) at the Henley Business School of the University of Reading. The present research was co-funded by the European Commission under the 6th Framework programme's Research Infrastructures Action (Trans-national Access contract RITA 0206040) hosted by IRISS-C/I at CEPS/INSTEAD, Differdange (Luxembourg). We have also benefited from travel grants from the University of Lille 1 and the Royal Economic Society. We thank Mark Casson, Giacomo De Luca, Nigar Hashimzade, Carsten Hefeker and Roland Vaubel for detailed comments, as well as Peter Bernholz, Marina Della Giusta, Arye Hillman, Stéphane Lambrecht, Yves Rolland and Stéphane Vigeant for helpful remarks. Feedback is acknowledged from the 4th International Annual Meeting of the Economic and Social Data Service in London (2008), a seminar at Reading (2008), the 43rd Annual Meeting of the Canadian Economic Association in Toronto (2009), the 26th International Symposium on Money, Banking and Finance in Orléans (2009) and the 18th Silvaplana Workshop on Political Economy (2009). The usual disclaimer applies.

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1 Introduction

Is low inflation here to stay? Competing theories may provide hints about the likely permanence – or not – of the contemporary low-inflation regime. Some would probably insist on the evolution of monetary institutions, more independent and more focused on price stability during the recent period of Great Moderation than in the last episode of Great Inflation (see, e.g., Crowe and Meade, 2007). Others have pointed to globalization as a weight on inflationary pressures (see, e.g., Gamber and Hung, 2001, and Rogoff, 2003). However, such theories, as well as the mechanisms and policies implied, address the 'how did we arrive there?' question rather than the one that naturally follows, i.e., 'where do we go from here?'.

More deeply rooted explanations of the worldwide trend toward low inflation are therefore needed to answer the second question. In such a context, inflation preferences are fundamental, as their dynamics is shaping a nation's inflation prospects. Hence, investigating the long-run evolution of inflation aversion is crucial to determine if low inflation is here to stay or if central banks have to be wary of inflation, whatever their degree of independence. One thus has to focus on social preferences with regard to the desirable inflation and explore their transmission from one generation to another. Along such lines, part of an explanation would lie in the 'inflation culture' societies have built through history (see, e.g., Hayo, 1998, and Vaubel, 2003). Whereas most of the literature in economics assumes preferences as 'priors' which are endowed to agents and do not change, a more promising route to understand the key determinants and the sustainability of the recent low-inflation regime is to look at preferences as shaped out by evolutionary and cultural forces in society. Dual inheritance theory in anthropology and other social sciences, treated at length in Cavalli-Sforza and Feldman (1981) and Boyd and Richerson (1985), suggests that genes (or 'nature') are not the only factor responsible in influencing traits and practices of individuals. While it takes a large number of generations for such evolutionary inheritance to mutate, beliefs, values and behavior inherited as culture (in a general sense, imitative or social learning typical mostly for humans, and often dubbed 'nurture') can be modified much faster, in a generation or two, as individuals and societies adapt in response to observation and experience.

In particular, when it comes to intergenerational transmission of socially-relevant attitudes such as inflation aversion, as in the present paper, the entire effect on the dynamics of preferences would rather belong to culture, and not to genes. There is anthropological evidence that culture influences risk aversion (Henrich and McElreath, 2002) and judgement (Nisbett, 2003). And from an economist's point of view, it has been argued by Hayo (1998) that preferences for low inflation may have their roots in a nation's culture. Of course, culture and preferences are ultimately moulded by history, as

relevant past experience – e.g., hyperinflationary episodes in the context here – is then transferred as collective memory to the next generations (Vaubel, 2003).[1] Thus, it is not surprising that, as Scheve (2004) shows, there is significant cross-country variation in inflation aversion, while Jayadev (2006) reveals that such preferences may also originate in an individual's relative position in society.

Based on such a departing hypothesis, we endogenize inflation aversion preferences as being culturally transmitted from one generation to another, in a process of socialization where parents and peers affect the adoption of a given trait (degree of inflation aversion, in our case) depending on chance, effort and learning from the relevant history (materialized inflation). In implementing this approach, we follow Bisin and Verdier (2000, 2001) who build on the literature within economics on endogenous preferences[2] to develop and analyze formal set-ups where preferences evolve across generations. Though these authors are interested in the provision of public goods, their framework has more recently been used by Bisin et al. (2004) and Sáez-Martí and Sjögren (2008) to study the transmission of cultural traits. We here extend this framework to investigate how the intergenerational dynamics of inflation aversion is influenced by endogenous preference transmission in response to learning from inflation experience[3] and the resulting collective memory; and, in effect, to throw more light on the question whether 'low inflation is here to stay'.

It may seem surprising that very few papers have examined the long-run stability of inflation aversion. However, in addition to the constraining assumption of exogenous preferences in theoretical models, this outcome probably also reflects a simple empirical trend: economists now generally admit that central bank independence – embodied in laws and regulations in many countries over the last two decades – reveals a society's inflation aversion. From such a perspective, then, everything appears as if the world

[1] 'Collective memory' is a concept introduced by Halbwachs (1925), but mostly developed in social science since the 1970s, together with the related notions of 'historical memory' and 'common memory'. It has been used across a wide spectrum of contexts, e.g., to designate monuments and acts to remember past atrocities (e.g., Nelson and Olin, eds., 2003) or contractual reminder devices for forgetful agents (e.g., Miller and Rozen, 2009). Mithander et al., eds., (2007) associate collective memory with how individuals, communities and nations have dealt with their past through remembrance, historiography and legal settlements. We employ it mostly in its latter, narrower sense, as enshrined in a society's (here, monetary) institutions evolving out of common experiences, also the interpretation (there, related to individual cultural investment decisions) used by Dessí (2008).

[2] Which can be traced to Becker (1976), Hirshleifer (1977) and Rubin and Paul (1979); Becker (1996) is a widely cited book; Dekel et al. (2007) provide a useful update, in particular on the game-theoretic 'indirect evolutionary approach' we do not pursue here.

[3] For an early analysis of social learning and personality development in cognitive psychology, see, e.g., Bandura and Walters (1963); for a compact survey of learning models in economics, see, e.g., Sobel (2000).

has evolved towards higher inflation aversion, evidenced by the rising number of central banks made independent or, for the ones which were already, by the increase in their degree of independence (see Guillén and Polillo, 2005, Crowe and Meade, 2007, or Arnone et al., 2009, for example, who document this evolution). Yet, though the trend has been towards more independence, we do not know if a reversal would not occur and, this, all the more so since legal attempts to restrict central bank independence can be rewarding for short-sighted politicians (see, e.g., Waller, 1991). Hence, this paper goes deeper by exploring the long-run drivers of inflation aversion in order to assess the sustainability of the low-inflation regime.

In the first part of the paper, we analyze the dynamics of inflation aversion preferences in an overlapping-generations (OLG) model with heterogenous mature agents characterized by different degrees of inflation aversion. We begin by showing how the stability of a society's degree of inflation aversion in a deterministic version of our framework depends on the direction and speed of changes in the structure of the population's preferences, implying an ultimate survival of one of the types and complete extinction of the other (as in evolutionary models explored within economic contexts). We then discuss how convergence to an interior equilibrium can emerge under the presence of cultural substitution in the socialization efforts of parents (as in the methodologically related papers by Bisin and Verdier, 2000, 2001, and Sáez-Martí and Sjögren, 2008). However, one of the main contributions of the paper is to demonstrate that in a further, more realistic extension of the set-up to a stochastic process for inflation implying learning from observed history and a corresponding influence on the exerted socialization effort (for given socialization costs), an irregular long-run cyclical pattern in the dynamics of social preferences may be generated.

In the second part of the paper, we empirically test the key theoretical predictions derived from our model. To do so, we first construct a novel, survey-based measure of inflation aversion appropriate for our purposes. Given the lack of time series in an intergenerational context, we then implement a cross-section check of the implications of our theory. Applying weighted least squares (with alternative weighting vectors) to a sample of the 33 countries participating in the International Social Survey Program on the Role of Government (ISSP RoG), the wave of 2006, we find evidence that the proportion of retirees (by its own or relative to the proportion of the working age population), as a proxy for the more inflation-averse type, is strongly associated with a society's degree of inflation aversion. Moreover, our regressions also confirm the relevance of the other key factors influencing the degree of inflation aversion highlighted in our model, such as the experience with high inflation, the degree of central bank independence, and the respect of the rule of law in its dimension of property rights. Our findings thus imply that, with an ageing population structure as a stable trend and no major exogenous inflation shocks over the next generation span or so,

low inflation is here to stay.

The paper is structured as follows. Section 2 presents the model, focusing on the types of preferences and the dynamics of preference transmission across generations; in it, we analytically demonstrate, and illustrate by simulations, how the evolving structure of the population and parents' socialization efforts respond to experience with inflation. Section 3, in turn, presents our empirical application in support of the theoretical results. The final section concludes, while Appendix A presents the data definitions and sources.

2 Theoretical Framework

We here build on the OLG set-up of Bisin and Verdier (2000, 2001), to extend and apply it to the long-run evolution of inflation aversion.

2.1 Preference Types and Monetary Institutions

A generation consists of a continuum of individuals, each living for two periods and having one offspring, so that the population is constant and the size of the mature generation is normalized to one. We consider two types, a and b, of preferences in the population defined on a private good c and a public good G, which we interpret narrowly as independence of the central bank. In the beginning of their mature life, all individuals receive an identical endowment ϖ. The degree of central bank independence is decided in each period by majority voting in parliament through proportional representation of the mature generation.[4] Following Bisin and Verdier (2000), we assume that each period t each adult chooses the total amount of the public good, G_t, knowing that everyone else in the society, irrespective of preference type, will have to contribute an equal share, $\frac{G_t}{1}$ (where unity in the denominator comes from the normalization of the mature population), towards the cost of providing the public good in the same period.[5] However, only agents of type a prefer a strongly independent central bank, whereas agents of type b have milder preferences with regard to central bank independence. In effect, all agents value central bank independence. But the particular degree of independence depends on the outcome of voting in parliament each period, as a direct projection of the proportion of each type of inflation-aversion preferences in the society. In our set-up, therefore, the

[4] Modeling the political system is out of the scope of this article, and we refer the reader to Faust (1996), Bullard and Waller (2004) or Berentsen and Strub (2009).

[5] The literature on the private provision of public goods allows a less restrictive setting where each agent chooses his contribution, in units of consumption good, and the resulting amount of the public good equals the sum of all contributions. We leave this avenue for future research.

benefits of central bank independence are implicit,[6] the choice being between different degrees of independence. Preferences, then, can be represented in the following (separable) form:

$$u^i(c_t, G_t) = u^i(c_t) + \gamma^i \upsilon^i(G_t), \quad \text{with} \quad i \in \{a, b\} \text{ and } \gamma^a > \gamma^b > 0$$

where $u(c_t)$ and $\upsilon(G_t)$ are strictly concave, increasing functions satisfying $u'(0) = \upsilon'(0) = \infty$.

A particular degree of central bank independence, if voted in period t, entails at the same time a social cost, i.e., some function $G_t(\cdot)$. This is an aggregate cost to society which can come from several sources. It could, for example, be related to a distortion of the Phillips curve trade-off that may arise at very low levels of inflation. This argument has been raised by Akerlof et al. (1996) and Benigno and Ricci (2008), the mechanism behind it being that the sacrifice ratio would increase at low levels of inflation. Such a situation may be perceived as costly by (part of) the electorate.[7]

Without loss of generality and following the huge literature on the provision of public goods, the social cost of central bank independence is hereafter expressed in terms of good c. If the fraction q_t^i, with $0 \leq q_t^i \leq 1$, of type $i \in \{a, b\}$ individuals at time t is more than a half, then $q_t^i > q_t^j$, and the voting equilibrium degree of central bank independence solves the maximization program of the type i (identical) agents

$$\max_{G_t} \quad u^i(c_t, G_t) \quad \text{s.t. } c_t + \frac{G_t}{1} \leq \varpi,$$

so that the corresponding unconstrained optimization problem can be written as

$$\max_{G_t} \quad u^i(\varpi - G_t) + \gamma^i \upsilon^i(G_t),$$

$$\begin{aligned} \text{with FOC} \quad : \quad & \frac{\partial \left[u^i(\varpi - G_t) + \gamma^i \upsilon^i(G_t) \right]}{\partial G_t} = 0 \\ \Leftrightarrow \quad & u^{i\prime}\left(\varpi - G_t^{i*}\right) = \gamma^i \upsilon^{i\prime}\left(G_t^{i*}\right) \\ \Leftrightarrow \quad & u^{i\prime}\left(\varpi - G^{i*}\right) = \gamma^i \upsilon^{i\prime}\left(G^{i*}\right). \end{aligned} \tag{1}$$

Equation (1) implicitly defines the optimal social cost $G_t^{i*}\left(\varpi, \gamma^i\right) = G^{i*}\left(\varpi, \gamma^i\right) = const$ (given that the endowment $\varpi = const$ is identical across

[6] The literature has widely insisted on such benefits (see notably the survey by Berger *et al.*, 2001, or Crowe and Meade, 2007), so we avoid their discussion here, to focus on our point.

[7] One could also think about relating the social cost of central bank independence to transparency and accountability issues, which induce a (costly) degree of monitoring by the polity of the central bank's actions.

time periods as well as mature individuals, which was assumed as a natural counterpart to the assumed constant population above) and the corresponding preferred degree of central bank independence of type i agents in any period t. Plugging that constant optimal degree of central bank independence back into the utility yields the value function of the type i agent:

$$\begin{aligned} V^i(\varpi) &\equiv \arg\max_G \quad u^i(\varpi - G) + \gamma^i \upsilon^i(G) \\ &= u^i\left[\varpi - G^{i*}\left(\varpi, \gamma^i\right)\right] + \gamma^i \upsilon^i\left[G^{i*}\left(\varpi, \gamma^i\right)\right] \end{aligned}$$

Because of the optimality of $G^{i*}(\cdot)$ and the positivity of $\gamma^i > 0$,

$$V^i(\varpi) > u^i(\varpi)$$

so that it is always in the interest of a type i mature agent to enjoy the public good, here her particular, preferred degree of central bank independence, namely $G^{i*}(\cdot)$.

However, the exact *degree* of central bank independence is determined by the dominant type of agents' preferences via representation in parliament. From (1) above, we have:

$$\gamma^a = \frac{u^{a\prime}(\varpi - G^{a*})}{\upsilon^{a\prime}(G^{a*})} > \frac{u^{b\prime}\left(\varpi - G^{b*}\right)}{\upsilon^{b\prime}(G^{b*})} = \gamma^b > 0 \tag{2}$$

Hence, the optimal degree of independence for each type is shaped by the agent's endowment and the way she feels affected by the cost of central bank independence. In other words, the higher the cost, the lower the optimal degree of independence to be accepted by the agent. If an agent feels that her net consumption possibilities $(\varpi - G)$ would be reduced under a higher degree of independence, because such an independence would imply a lower level of inflation and thus, along the lines of the above argument, a deterioration of the sacrifice ratio, her opposition to an increase in the degree of independence would be stronger. However, the marginal rates of substitution (MRS) of private good consumption for public good consumption across types implied by (2) differ, with type a's such MRS being higher (which is consistent with the higher degree of central bank independence preferred by this type in the population) than type b's MRS. Therefore the overall dynamics of the fraction of each type in the population will influence the intergenerational transmission of inflation aversion, by socialization and voting behavior each period, as we show in the next subsection.

To anticipate on the empirical application provided further down, one can think of the active working-age population as one type (b in our interpretation) who, fearing the consequences of a less favorable inflation-output trade-off on their probability of finding a job quickly in a recession, would support a lower degree of central bank independence than retirees, for whom

such concerns resound less than the protection of their savings from inflation. This reinforces the need to consider the stability of the central bank independence solution to the inflation bias, as the mechanisms supporting this solution may not be permanently operative in the economy.

2.2 Deterministic Dynamics of Preference Transmission

As in Bisin and Verdier (2000, 2001) and Sáez-Martí and Sjögren (2008), we begin by modeling the transmission of inflation aversion preferences as occurring through socialization. We then extend their framework to account for learning from experience in a dynamic-stochastic economic environment.

Children are born 'naive', i.e., with not well-defined preferences, but acquire them through observation, imitation and adoption of 'cultural models' with which they are matched. This matching, termed 'socialization', naturally comes in two steps and is influenced to some extent by economic choices, but also by parents. Children are first exposed to their parents model (type a or b), and are thus 'matched' with their family, in what can be termed 'vertical transmission'. If they do not adopt their parents' trait, they are then exposed to the influence of other individuals of the old generation (e.g., teachers, peers, role models) and adopt the preference type of some among these, i.e., 'oblique transmission'.[8]

Moreover, 'imperfect empathy' is assumed throughout the paper, a common assumption in the emerging socialization literature within economics. It means that parents can perceive the welfare of their children only through the filter of their own preferences. Imperfect empathy is thus a particular form of myopia which implies that parents always want to socialize their children to their own preferences and cultural traits, in essence because they think this will have positive consequences for their children's life (in material or nonmaterial sense). In our set-up the assumption would imply that parents consider the benefits of their preferred degree of central bank independence desirable enough so that they feel a moral duty to bequest it. Such a conviction may arise from a kind of 'veil of ignorance' reasoning by the adult population, or – rather, in our intergenerational context – from past experience transmitted to them by their own parents.[9]

Exogenous Vertical Preference Transmission To examine the mechanism driving the intergenerational transmission of inflation aversion, the present subsection initially supposes that the child adopts his parent's pref-

[8] Terminology taken from the anthropological and psychological literature, notably Cavalli-Sforza and Feldman (1981). See Lipatov et al. (2008) or McElreath and Strimling (2008) for examples of the continued use of the concepts.

[9] For example, Shiller (1997) shows that older Germans have stronger inflation aversion than their offspring, a cultural trait with an origin that can be traced back to the hyperinflation episodes experienced in 1923 and 1948.

erences with a fixed (exogenous) probability τ^i, with $0 \leq \tau^i \leq 1$, $i \in \{a, b\}$. With probability $1 - \tau^i$, the child is matched randomly with another individual of the old generation and adopts her preference type.

Then, consider the transition probabilities at time t, P_t^{ij}, that a parent of type i has a child adopting a preference of type j:

$$\begin{aligned} P_t^{aa} &= \tau^a + (1 - \tau^a)\, q_t^a \\ P_t^{ab} &= (1 - \tau^a)\,(1 - q_t^a) \\ P_t^{bb} &= \tau^b + \left(1 - \tau^b\right) q_t^b = \tau^b + \left(1 - \tau^b\right)(1 - q_t^a) \\ P_t^{ba} &= \left(1 - \tau^b\right)\left(1 - q_t^b\right) = \left(1 - \tau^b\right) q_t^a \end{aligned}$$

Given these transition probabilities, the fraction q_t^a of adult individuals of type a in period $t + 1$ evolves according to:

$$\begin{aligned} q_{t+1}^a &= q_t^a P_t^{aa} + q_t^b P_t^{ba} \\ &= q_t^a P_t^{aa} + (1 - q_t^a)\, P_t^{ba} \\ &= q_t^a + q_t^a\,(1 - q_t^a)\left(\tau^a - \tau^b\right) \\ &= \left[1 + (1 - q_t^a)\left(\tau^a - \tau^b\right)\right] q_t^a \end{aligned}$$

It is clear from the last line above that the fraction of type-a agents in the old generation may stay constant across time only if the term in square brackets is equal to 1. This would occur if either (i) $q_t^a = 1$ or (ii) $\tau^a = \tau^b$ or (iii) both. However, case (i) – and, hence, case (iii) – is excluded by assumption for the initial condition ($0 < q_t^a < 1$), as otherwise a stable structure of the mature population's preferences emerges, in which the initial type of preferences perpetuates forever. Therefore, only case (ii) remains as a potentially relevant, symmetric option to consider; yet, it defines a steady state for any initial condition, without any evolution of the relative proportions of preferences in the society, and so is uninteresting for our purposes.

In all other cases, different from (i), (ii) and (iii), the intergenerational dynamics of preferences depends on two parameters: first, the proportion of type-a agents inherited from past history, q_t^a, relatively to that of q_t^b; second, the *sign* of the difference of the vertical transmission probabilities, $\tau^a - \tau^b$, which determines the *direction* of preference convergence. Writing the last-but-one line above as

$$q_{t+1}^a = q_t^a + \left[q_t^a - (q_t^a)^2\right]\left(\tau^a - \tau^b\right) \tag{3}$$

delivers a first-order non-linear sequence, which does not admit any general solution. However, given the assumptions on τ^a and τ^b, we know that the stability points of this function are 0 and 1. The conditions for convergence are the following:

- If $\tau^a < \tau^b$, then for any initial condition q_0^a, $q_{t\to\infty}^a \to 0$: social preferences will converge towards an economy with only type-b agents, i.e., a lower degree of central bank independence.
- If $\tau^a > \tau^b$, then for any initial condition q_0^a, $q_{t\to\infty}^a \to 1$: social preferences will converge towards an economy with only type-a agents. In this case, given the direction of preference transmission convergence, we can say that inflation aversion and, consequently, central bank independence are here to stay. Otherwise, the intergenerational stability of monetary arrangements favoring central bank independence can not necessarily be sustained.

Since by definition $0 < q_0^a < 1$, no case can be ruled out, and everything will depend on the relative size of τ^a and τ^b. To illustrate this result, we present phase diagrams for the two opposite cases, namely where the difference between the probabilities of transmitting a parent's preference type to her child is positive, $\tau^a - \tau^b > 0$, or negative, $\tau^a - \tau^b < 0$. As can be seen in Figure 1, if the sign of the vertical-preference-transmission probability differential between types a and b, $\tau^a - \tau^b$, is positive, then the intergenerational dynamics of the fraction of preference type a converges to the steady state S with coordinates $(1, 1)$ for any initial condition q_0^a. The process is driven by the concavity of the phase diagram curves (drawn for different magnitudes of the mentioned probability differential), no matter how large the positive differential in question may be. This leads to an ultimate adoption of type a agents' preferences – which is the only preference type to survive, while the other type is extinguished – implying perpetuation of the higher degree of central bank independence in the deterministic model version with exogenous vertical transmission we developed thus far. Conversely, Figure 2 shows that if the probability differential $\tau^a - \tau^b$ is negative, then the preferences of society converge to type b at the steady state S' with coordinates $(0, 0)$ for any initial condition q_0^a. The convexity of the phase diagram curves in this case, no matter how large the negative vertical-preference-transmission probability differential may be, directs convergence to an ultimate equilibrium where only type b survives, which results into perpetuation of the lower degree of central bank independence.

[Figures 1 and 2 about here]

Interestingly, the speed of the preference convergence process depends – no matter its direction (to extinction of type b or a) – on (the absolute value

of) the magnitude (or size) of the vertical-preference-transmission probability differential, itself determining the curvature of the path of the fraction of type-a preferences in our two phase diagrams. The larger (the modulus of) this differential (e.g., compare the graphs for 0.9 versus 0.1 in Figure 1 and for -0.9 versus -0.1 in Figure 2), the more curved the path and the quicker the convergence process.

Endogenous Vertical Preference Transmission Differently from the situations depicted in figures 1 and 2, real-world cultural heterogeneity does not seem to necessarily exhibit such convergence to an ultimate survival of one of the types, with the others extinguished (as in evolutionary selection mechanisms). Instead, an equilibrium where different types of preferences coexist would rather be sustained. Certain conditions on the transmission mechanism that induce heterogeneity in the long-run stationary distribution of preferences in the population have been examined by Bisin and Verdier (2001). However, in their set-up this analysis comes at the cost of imposing cultural substitution (as in Sáez-Martí and Sjögren (2008) too), which may be quite restrictive. Cultural substitution means that the direct vertical socialization of children (inside the family) and their oblique socialization (outside the family) act as substitutes in the cultural transmission mechanism. Then, there can exist a heterogeneous distribution of preferences in the population which is globally stable. Intuitively, direct vertical transmission acts as a cultural substitute for oblique transmission when parents have less incentives to socialize their children once their values are widely dominant in the population.

For illustrative purposes, we can assume cultural substitution in the same way: the probability at time t of vertical socialization to the parent's trait i, τ_t^i, will be a negative function of the attained level of the fraction in the population with that same trait, q_t^i; that is, we can write $\tau_t^i\left(q_t^i\right)$, with $\frac{d}{dq_t^i}\tau_t^i\left(q_t^i\right) < 0$. Then (3) becomes:

$$q_{t+1}^a = q_t^a + \left[q_t^a - (q_t^a)^2\right]\left[\tau^a\left(q_t^a\right) - \tau^b\left(1 - q_t^a\right)\right] \tag{4}$$

In this formulation, the effort (or some other cost) of the parent to socialize her child in her own trait decreases as the parent observes a large fraction in the population that has already attained the trait, so that it becomes more likely for the child to be matched to the same trait even outside the family. In our context, equation (4) will have the same consequences as in the quoted papers, i.e., to drive the dynamics of the system to an ultimate convergence to an interior equilibrium.

However, inflation aversion can, more realistically, be considered as a gradual outcome of past experience and the lessons from it embodied in institutions. Recall that such a view is, in particular, consistent with Hayo's

(1998) 'inflation culture hypothesis'. This leads us to relax the cultural substitution assumption, and to address nondeterministic environments where learning from inflation experiences feeds collective memory.

2.3 Stochastic Dynamics of Preference Transmission

Allowing for a richer dynamics requires to endogenize the vertical transmission of preferences in a stochastic extension of the set-up described thus far. Combining features of the preceding subsections but keeping the model as straightforward as possible given our objective, and in line with similar mechanisms in the literatures on cultural transmission and social learning, we now incorporate into it several new features.[10]

First, we now assume that the probability at time t of vertical socialization to the parent's trait i, τ_t^i, is a positive function of the effort the parent exerts to socialize her offspring to her own trait, e_t^i: $\tau_t^i\left(e_t^i,\cdot\right)$, with $\frac{\partial}{\partial e_t^i}\tau_t^i\left(e_t^i,\cdot\right)>0$. In other words, the more efforts a parent puts, the more efficient her transmission to the next generation.

Second, we assume that the latter effort, e_t^i, in turn, is a positive function of the severity of inflation (π_t) a particular generation has witnessed (on average, per annum, or as an annual maximum) in its adult life-span t relative to the inflation observed by the preceding generation (π_{t-1}), i.e., that of their parents. Thus, we write: $e_t^i\left(\pi_t-\pi_{t-1},\cdot\right)$, with the following comparative statics property: $\frac{\partial}{\partial(\pi_t-\pi_{t-1})}e_t^i\left(\pi_t-\pi_{t-1},\cdot\right)>0$. The meaning of this assumption is that, when a generation has suffered from high inflation, it has taken steps to ensure that the future generations will not be driven to the same fate. One can think of institutional modifications, here an increase in the degree of central bank independence, as an effective measure in that sense. Hence, the effort will depend on the (memory of) past history of inflation.

Third, and final, to fully specify the model, one has to assume some dynamics for the forcing variable, π_t. To keep the set-up as general as possible, we assume that inflation is driven by a simple stochastic low-frequency (since our t covers a generation span) autoregressive process, e.g., $\pi_t=\rho\pi_{t-1}+\varepsilon_t$ with ε_t drawn from a normal distribution (allowing for different specifications of the mean and variance, as explained further down).

[10] Note that we consider immediately the endogenous case. A theoretical exploration of the exogenous case under stochastic dynamics would imply to specify stochastic processes for the probabilities of vertical transmission probabilities (τ_t^i). Assuming them random variables, e.g., draws from uniform $(0,1)$ independent distributions each period in the simplest context, would lead one to rewrite (3) as $q_{t+1}^a=q_t^a+\left[q_t^a-(q_t^a)^2\right]\left(\tau_t^a-\tau_t^b\right)$. Our simulations of this equation with stochastic τ_t^i's from diffrent q_0^a generate ultimate convergence to either of the types, as in the deterministic exogenous case, within 20 to 100 periods depending on the particularly materialized sequences of $\tau_t^a-\tau_t^b$. Other simulation results, where the vertical transmission probabilities are stochastic but endogenous, are reported in more detail further down.

From these assumptions, we substitute back in our key dynamic equation to obtain:[11]

$$q_{t+1}^a = q_t^a + \left[q_t^a - (q_t^a)^2\right] \begin{pmatrix} \tau_t^a \left[e_t^a \left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right] \\ -\tau_t^b \left[e_t^b \left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right] \end{pmatrix}, \tag{5}$$

with $e_t^a \left(\pi_t - \pi_{t-1}, \cdot\right) > e_t^b \left(\pi_t - \pi_{t-1}, \cdot\right)$ whenever $\pi_t - \pi_{t-1} > 0$, and inversely in the opposite case.

The stochastic process driving inflation dynamics will first impact the socialization effort across types, then the preference transmission probabilities, and ultimately the evolution of the proportions of types across generations. This chain of effects constitutes the mechanism generating irregular cycles of temporary convergence towards one trait in the population or the other. For example, if in equation (5) past-period inflation has been relatively high, socialization and voting will have taken place, potentially increasing the degree of central bank independence. The present adult generation may thus feel more insulated from misguidance (meaning, high inflation), and its effort to socialize children (to stronger inflation aversion) will be reduced. A period of convergence away from the high inflation aversion the preceding generation had built (and potentially transformed in inflation-proof institutions) would then follow. Hence, preference shift cycles can arise and reverse each other.

To explore further this mechanism, we simulated our model under alternative parameters and shock processes. Our benchmark simulations concerning inflation dynamics assumed, alternatively, 3 cases:[12]

1. $\pi_0 = \mu_\varepsilon = 0$ and $\sigma_\varepsilon^2 = 1$, i.e., a zero-inflation regime, or one consistent with zero-inflation steady states in theoretical models;

2. $\pi_0 = \mu_\varepsilon = 2$ and $\sigma_\varepsilon^2 = 1$, i.e., a low-inflation regime, or one broadly typical for advanced economies over the most recent generation span; and

3. $\pi_0 = \mu_\varepsilon = 6$ and $\sigma_\varepsilon^2 = 3$ (all these 3 parameters 3 times higher than in case 2), i.e., a high-inflation regime with higher volatility, or one broadly typical for emerging markets over the most recent generation span.

Moreover, all 3 benchmark cases were simulated for 3 alternative (constant) values of the parameter measuring low-frequency inflation persis-

[11] The adopted formulation leaves for further research the inclusion of other potential determinants of effort (such as the cost of preference transmission), as well as of the probability that the child keeps the trait of his parent for a different reason (such as influences of peers or fashions), both captured by the $(, \cdot)$ notation in the respective functions.

[12] Our R programs and results are available upon request.

tence,[13] $\rho = \{0.9, 0.5, 0.1\}$, and for 3 endogenous vertical probability differentials, $\left|\tau_t^a\left[e_t^a\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right] - \tau_t^b\left[e_t^b\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right]\right| = \{0.5, 0.2, 0.1\}$, translating the reaction to observed inflation into corresponding effort and, ultimately, probability of passing over the parent's trait to the child for the two types[14]. In short, our simulations assumed that type-a agents increase their socialization effort and, hence, their vertical transmission probability every time when current-period inflation is higher than previous-period inflation; otherwise they decrease their effort. Symmetrically, type-b agents increase their socialization effort and, hence, their vertical transmission probability every time when current-period inflation is lower than previous-period inflation; otherwise they decrease their effort. The magnitude of this increase or decrease is discretized in the simulations into corresponding probability numbers whose difference yields 3 cases, namely: an absolute value of 0.1 (obtained as in the footnote above) captures the case of a low endogenous vertical probability differential, an absolute value of 0.2 (obtained analogously from probabilities of 0.6 and 0.4) accounts for an intermediate case, and an absolute value of 0.5 (obtained from probabilities of 0.75 and 0.25) features a high vertical probability differential. Figure 3 summarizes our most interesting results, and the mentioned cases are depicted in each of its three panels, respectively, for an underlying inflation process with $\pi_0 = \mu_\varepsilon = 2$ and $\sigma_\varepsilon^2 = 1$ (i.e., a low-inflation regime) and $q_t^a = 0.5$.

[Figure 3 about here]

Our model simulations pointed to the following conclusions. First, whenever the induced socialization effort following experience with inflation and, hence, the resulting vertical transmission probability differential is sufficiently high, $\left|\tau_t^a\left[e_t^a\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right] - \tau_t^b\left[e_t^b\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right]\right|$ of the order of 0.5 or more, convergence may take more than 75 or 100 generation spans but it ultimately most likely occurs to one of the types. The conclusion is kept when starting from an equal initial share in the population, $q_t^a = 0.5$, depending on the sequences of materialized inflation shocks. Under the particular sample for the inflation process drawn and illustrated in the bottom panel Figure 3, the ultimate convergence is to $q_t^a \to 1$, with type-b extinguished. This pattern, as well as the inverse one of ultimate convergence to $q_t^b \to 1$, with type-a extinguished, similarly occurred when simulating

[13] Note that in our model context persistence of the inflation process at generation spans (t of the order of 25-30 years), i.e., at low frequency, may not necessarily correspond to measured short-run (for annual or quarterly t) inflation persistence, i.e., at high frequency, in the abundant literature.

[14] The simulations also assume a symmetric socialization effort by the two types, in the sense that, for example, when $\tau_t^a(\cdot) = 0.55$ and $\tau_t^b(\cdot) = 0.45$ after an observed increase in inflation, then $\tau_t^b(\cdot) = 0.55$ and $\tau_t^a(\cdot) = 0.45$ after an observed decrease in inflation: this results into the low endogenous vertical probability differential case (the top panel in Figure 3) where: $\left|\tau_t^a\left[e_t^a\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right] - \tau_t^b\left[e_t^b\left(\pi_t - \pi_{t-1}, \cdot\right), \cdot\right]\right| = 0.1$.

the purely stochastic exogenous τ_t^i's (as mentioned earlier in a footnote). However, the convergence process is much slower in our endogenous case.

Second, the main insight from the simulations highlights the possibility of irregular preference shift cycles manifested in a sequence of interior values for the fraction of types which does not converge to any of the two corner steady states, as illustrated in the top and middle panels of Figure 3. The conditions which lead to such dynamics of the degree of inflation aversion are the following two: (i) the endogenous vertical probability differential should be relatively low (about or less than 0.1 or 0.2 in absolute value); and (ii) the initial fraction should be close to the mid-point, $q_t^a \approx q_t^b$. The second condition is all the more of interest as it allows reversals at irregular intervals in the voted degree of central bank independence too, and not only preference cycles in the socialization effort. For that particular reason we present the simulation results starting exactly from $q_t^a = 0.5$ in Figure 3).

Hence, as the simulations show, our stochastic endogenous preference transmission set-up provides an alternative to the assumption of cultural substitution, by explicitly modeling the response of parents in their socialization effort – and, potentially, also voting outcome – to the change in inflation they have observed. The extension of the framework along such lines appears useful and realistic, as already argued in the present subsection.

To sum up, as our analysis and simulations suggest, endogenous preference transmission in a stochastic economic environment can be understood as a process of intergenerational social learning. In it, parent generations experience inflation and transmit their preferences (i.e., their degree of inflation aversion) and institutions (i.e., the corresponding degree of central bank independence they voted for) to children generations. Both these channels of transmission of a generation's preferences are, in essence, forms of collective memory: formal, through voting (on the degree of central bank independence, modified whenever majority switches), and informal, through socialization efforts (to influence inflation aversion preferences of their offspring, possible even when the type in question is in minority).

3 Empirical Evidence

The model developed in the theoretical section of the paper highlights a key determinant of the long-run evolution of inflation aversion, namely, the proportion of the type-a agents in the population (q_t^a), itself driven by socialization effort (e_t^i) which is a function of inflation dynamics ($\pi_t - \pi_{t-1}$). In this section, we provide empirical evidence that supports the model's assumptions and implications. We first present the novel measure of inflation aversion we had to construct out of survey responses for our purposes, and describe how it differs from the few existing ones in the literature. We then

turn to the discussion of our approach in implementing a relevant test for the proposed theory and of our econometric results.

3.1 Measuring Inflation Aversion

The focus of our model and, by way of consequence, the dependent variable in our regressions is the degree of inflation aversion. Its intergenerational transmission being of central interest here, the OLG framework we applied and extended was designed for the analysis of long-run dynamics. However, there does not exist, to our knowledge, inflation aversion measures spanning generation-long periods. We thus have to resort to cross-section estimations in assessing the impact of the determinants of inflation aversion highlighted by our theory.[15]

Our measure of inflation aversion is based on the International Social Survey Program (ISSP) conducted by the Inter-university Consortium for Political and Social Research, which collects nationally representative data in a way that is comparable across countries. We employ the 2006 survey, providing us with data from 33 countries on answers from individuals to questionnaires concerning the role of government in society (Role of Government, wave IV, hereafter abbreviated as RoG IV). To measure inflation aversion, we aggregate some of the answers to the following question (7b):

> *On the whole, do you think it should or should not be the government's responsibility to keep prices under control?*

The potential answers proposed to the respondents are: 'definitely should be', 'probably should be', 'probably should not be', 'definitely should not be', 'can't choose' and, finally, 'no answer'. Hereafter, we use the sum of the percentage shares of the answers having chosen the first two possibilities as measuring a country's degree of inflation aversion. We, in effect, construct a survey-based measure of absolute inflation aversion, which is different from the few other measures one can find in the literature.[16] More precisely, Scheve (2004) and Jayadev (2006) have also analyzed data from the ISSP, but from the preceding wave (ISSP RoG III, run in 1996), and have made use of a measure of relative inflation aversion, employing a different question, where respondents are asked if the government's priority should be to fight unemployment or inflation. Such a measure is directly related to a business cycle framework (and to a kind of Phillips curve mechanism), and could thus not be used in our context, hence our choice of an absolute measure of

[15] Our dataset and EViews programs are available upon request.

[16] It has to be added that no confusion could exist in respondents' minds, as another question in the survey directly bears on the fixing of prices by law. The question we use is therefore clearly the one relevant to the (absolute) inflation preferences of people.

inflation aversion.[17]

Still another measure of inflation aversion in the literature is the index constructed by Krause and Méndez (2005) and employed in Krause and Méndez (2008) for 34 countries over a period of 24 years. This index is also defined as a relative degree of inflation aversion, and it aims at revealing policymakers' preferences. This measure is the weight a policymaker puts on inflation stabilization in an objective function optimized under short-term (meaning, business-cycle like) constraints. Hence, not only their measure is relative and centered on policymakers, but – like the other relative measure – it would be more useful for short-term analysis of perceived policy trade-offs rather than for studying the long-run trends our model focuses on.

Some descriptive statistics concerning our measure of absolute inflation aversion are exposed in Table 1. A striking finding is that, on average, all the countries in the sample are relatively inflation averse, as 86.4 percent of the respondents reply that governments should definitely, or probably, control inflation. Only one country, the Czech Republic, has a much lower degree of inflation aversion (67.4%). However, the remaining 32 countries are almost equally distributed in the three other quartiles, and the standard deviation for the whole sample is 8.3, or 10 percent of the average, which is a significant degree of variation. We will comment further down on country characteristics, when interpreting our empirical findings. But this brief overview of our sample shows that inflation aversion levels differ quite strongly among countries and regions and that such variations deserve to be explained.

[Table 1 about here]

3.2 Explaining Inflation Aversion

As Shiller (1997) notes, even more important than the international differences in inflation aversion are the intergenerational ones. Since the 1960s, demographic changes have been tremendous, as a large generation of baby-boomers is now entering into its retirement period. This generation has accumulated some savings in addition to their pensions, and this sheer fact would have contributed to make it much more conservative than it was in the 1960s. This would have remained unnoticeable except for the size of this generation, which has enabled baby-boomers to translate their evolving preferences into policies (see, e.g., Farvaque et al., forthcoming, for evidence on the role of this generation in the reduction in inflation). Thus, an obvious candidate to proxy the type-a agents is the share of retirees in the mature population, as retirees can be considered as being more inflation averse than

[17] Though there have been four waves of the ISSP survey on the Role of Government (1985, 1990, 1996 and 2006), only four countries participated in all four of them, thus precluding any time-series analysis.

working age people. To verify this feature (or, rather, hypothesis) in the data, implying a particular testable implication of our theory, we examine how retirees responded to the ISSP 2006 RoG IV question on inflation (question 7b, see above). Comparing the responses of retirees to the ones of the working age population shows that retirees are, in general, more inflation averse than people of working age. More precisely, the sum of the shares of the people responding that governments should, definitely or probably, keep prices under control is, on average for our total sample, larger for retirees than for the working age population.

Therefore, a first long-run determinant of the degree of inflation aversion in our empirical test is the proportion of retirees in the population. We employ both the share of the retirees and the ratio of the share of retirees to the share of working age population. These two variables summarize the preference structure of the theoretical economy described above, the proportion of retirees being the more inflation averse part of the mature population (which votes), i.e., they are our type-a agents, while the working age population in line with the above reasoning are our type-b agents.[18]

In the model as in the real life, evolving inflation aversion perceptions can be translated into the degree of central bank independence. During the last two decades at least, granting more independence to the monetary authority from the government has been thought of as a quick fix against inflation. It has also been econometrically shown that central bank independence can bear strongly on inflation (see, among others, Brumm, 2002, and the meta-regression analysis by de Haan and Klomp, 2008). Hence, the empirical verification of our model includes an index of central bank independence to account for the inflation aversion a society has embedded in its monetary institutions, as per our theory. Since our data on inflation aversion is from 2006, we make use of the central bank independence index computed by Arnone et al. (2009) for 2003. Yet, our sample of countries also includes emerging markets. In these countries, studies on central bank independence have consistently shown that indexes based on legal aspects are not always significant. To deal with this issue, the literature generally relies on the turnover of central bankers (see, for example, Dreher et al., 2008). Using such a measure in our framework, however, would be orthogonal, as turnover ratios are by definition related to short-term issues. Hence, to account for the fact that the rule of law is as important as the legal independence of the central bank, we include a measure of the protection of property rights, developed by the Heritage Foundation and now regularly considered as a reliable way to capture the respect for the law (see, for example, La Porta et al., 2004).

Finally, to proxy the channel in our model which highlights the impact of past experiences of high inflation transmitted through collective memory –

[18] A detailed description of our dataset and sources is to be found in the Appendix.

or, in other words, learning from history ($\pi_t - \pi_{t-1}$), we add to the regressors a dummy, equal to 1 when episodes of hyper- or high inflation have been known in the 20th century, using the classification in Fischer et al. (2002).

The cross-section equation intended to broadly test the key implications of our model is, thus, of the following general form:

$$InflAvers_t = \alpha + \beta Retirees_t + \gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \epsilon_t,$$

where *InflAvers* is our measure of absolute inflation aversion and *Retirees* is the share of retirees in the population or (depending on the regression, to be clarified further down) the ratio of the share of the retirees to the share of the working age population. Then, *HighInflDum* is the dummy representing past (high) inflation experiences, *CBI* is the central bank independence index, *PropRs* stands for the property rights index and ϵ is the error term. The equation is estimated by weighted least squares (WLS). WLS is a natural choice, insofar as our ISSP 2006 RoG IV sample includes countries as small as Ireland or Slovenia and as big as the US, Japan and Russia, in terms of both population and real GDP (which we choose as our two alternative weighting vectors). In the regressions weighted by the population, we also controlled for the effect of the country being richer or poorer, by employing the real GDP per capita for 2004 (from the World Penn Tables 6.2, see Heston et al., 2006).

The benchmark results from our estimation are presented in Table 2. The weighting vector consists of the respective population by country, data for 2004 (from the World Penn Tables 6.2, see Heston et al., 2006).

[Table 2 about here]

To capture the model's degrees of inflation aversion (type-a relative to type-b), regression 1 uses the ratio of the share of retirees to the share of workers as the key regressor of interest, plus real GDP per capita, the high inflation dummy, the CBI index and the property rights index, and an intercept. All the variables are statistically significant: the property rights index and real GDP per capita at the 10% level, and all other four at the 1% level, and all have signs in conformity with theoretical expectations. The explanatory power of the regression is very high. It thus appears that the higher the share of retirees with respect to the working age population, the higher is a country's inflation aversion. As was predicted by our model, it turns out that the historical experience countries have known negatively impacts inflation aversion. This confirms that high inflation in the past leads the contemporaneous generation to take steps to avoid returning to such a damaging path. Consequently, the current generation (their children) feels therefore more protected from inflation, and inflation aversion is reduced. This is confirmed by the negative sign on the CBI index coefficient, showing

that central bank independence reduces a country's inflation aversion, which we again interpret as agents feeling less threatened by inflation, and thus being less wary about it.

To test the joint importance of our collective memory proxy and the institutional arrangement resulting from the voting in our model, regression 2 adds to regression 1 an interaction term combining the high inflation dummy with the CBI index. The latter interaction term comes out as statistically significant at the 10% level and has the right negative sign. However, it invalidates the statistical significance of the high inflation dummy taken separately (as it is now accounted for in the interaction term) as well as that of the property rights index. It also increases the statistical significance of the main regressor of interest and its marginal impact on the degree of inflation aversion.

One minor inconvenience of this specification is that we cannot have a more precise quantitative interpretation concerning the marginal effect of the regressor of key interest on the degree of inflation aversion. To be able to judge about that, as well as to check robustness, we proceed to regression 3 by considering separately the shares of both retirees and the working age population, and not their ratio. This specification highlights two insightful results. First, the share of retirees remains statistically significant in determining inflation aversion, but not the share of the working age population. The type-a agents thus determine the degree of inflation aversion, which could be expected given the demographic evolutions the world has known in the last decades. Second, we can now see that an increase of one percentage point in the share of retirees leads to an increase of almost half a percentage point in the degree of inflation aversion, *ceteris paribus*. This is a very strong marginal impact, stronger than the comparable (being share variables) marginal impacts – all in the opposite, negative direction – of the CBI index (of about 13 basis points), the property rights index (of about 16 basis points, and only slightly insignificant at the 10% level), the high inflation dummy (8 basis points) and real GDP per capita (practically, of zero impact). Regression 4 finally adds the same interaction term (as in regression 2), which however now is not significant, making insignificant (again) both the high inflation dummy and the property rights index.

The real-world view – and our model's driving hypothesis – that a generation builds up inflation-fighting institutions when it suffers from high inflation is thus empirically corroborated by the WLS regression results we summarized. To further check robustness, we altered the weighting vector, now using real GDP instead of population. In this second weighting scheme we also had to omit one of the regressors in the first weighting scheme, namely, real GDP per capita, to avoid potential inference problems with the used weights. Insofar this variable showed up as significant, but with very low coefficients in the preceding set of results, such an omission now does not weaken the estimation. Table 3 shows the results from the WLS

specification with real GDP weighting.

[Table 3 about here]

As can be seen from the table, the change in the weighting vector does not affect in any important way our findings, neither qualitatively nor quantitatively. In particular, most of the regressors are still statistically significant at the 1% level and have the theoretically implied signs. Moreover, the coefficients have similar magnitudes to the analogous regression with population weights. Now, however, the inflation dummy becomes marginally insignificant, but the property rights index gains more significance in both statistical and magnitude sense. The overall fit of the regression is very high again. Adding the interaction term for the combined effect of the high inflation dummy and the CBI index slightly strengthens the regression, as the latter term is statistically significant at the 5% level and has the right negative sign. The other variables remain statistically significant as before (and the dummy is not significant as before), the overall fit staying practically the same. As was seen earlier in Table 2, this second specification slightly increases the statistical significance of the main regressor of interest (the share of retirees) and its marginal impact on the degree of inflation aversion.

Specifications 3 and 4 in Table 3 confirm the two important findings of the analogous regressions in Table 2: the share of retirees remains statistically significant in determining inflation aversion, but not the share of the working age population; and, we can see that an increase of one percentage point in the share of retirees leads to an increase of almost two-thirds of a percentage point in the degree of inflation aversion, *ceteris paribus*. Thus, the marginal impact of the share of retirees on the degree of a society's inflation aversion is even stronger when using real GDP weights instead of population weights. Moreover, the marginal impact of the share of retirees also remains higher (in absolute value) than the comparable effect of the CBI index (of about -11 basis points).

Putting the empirical results in a regional perspective is another worthwhile way to look at their relevance. Table 4 gives another view of our survey-based measure of absolute inflation aversion, organizing the countries by region.

[Table 4 about here]

First, it appears that countries belonging to the European Monetary Union (EMU) share a higher degree of inflation aversion than the rest of the sample and, interestingly, that this degree is higher than for countries that belong to the European Union (EU), but are not members of the EMU. This tends to show that the adoption of a high degree of independence for the

European Central Bank probably has not yet infused the whole population. That institutions do not have immediate impacts, but may need time to establish their credentials, is again in agreement with our model. This latter claim is also confirmed by comparing the inflation aversion levels in Germany and in Russia. Though both countries have suffered from hyperinflation, Germany has since had time to build inflation averse institutions (notably the Bundesbank, before joining the EMU), while Russia's central bank has still not received full independence from the government.

Second, and even more interesting is the high degree of inflation aversion in emerging market economies, and particularly among the non-European ones (94.3%), especially once one remarks that the regions where inflation aversion is the highest are also the ones with the lowest standard deviation. The high level of inflation aversion among emerging market economies can be related to their inflationary experience.

Third, as stated above, the Czech Republic has the lowest level of inflation aversion in our sample. This can notably be explained by the strong degree of central bank independence of its central bank (0.88, superior to the sample average of 0.72), even reinforced over the last decade by the adoption of an inflation targeting regime. Moreover, most of the countries that have in the last decades implemented such an inflation targeting regime show inferior levels of inflation aversion (in addition to the Czech Republic, that is the case for Canada, New Zealand, Poland, Sweden, United Kingdom). This tends to show that inflation targeting can back the more institutionalized degree of central bank independence.[19]

To sum up, in our view, the results are largely supportive of the model predictions. First, they show that the underlying evolution of a society's preferences is fundamental to observed macroeconomic trends such as, in our case, inflation. Second, they suggest that individuals may vary their socialization efforts to transmit their preferences, depending on the context and the relative incentives they have to face.

4 Conclusion

In this paper, we have developed a basic dynamic-stochastic framework appropriate to study the endogenous transmission of inflation aversion preferences across generations. We have shown that the stability of a society's degree of inflation aversion depends on the direction and speed of changes in the structure of the population, themselves a function of parent socialization efforts in response to observed inflation.

[19] The exceptions (i.e., inflation targeters that show slightly higher degrees of inflation aversion) are Australia and Hungary. Both countries have, however, recently known episodes of strong growth, for the former, and of political instability, for the latter, which may have re-ignited inflation scares among the population.

We have then proposed an empirical test of our theory, making use of an own, novel measure of inflation aversion constructed out of survey data. We have provided robust cross-section evidence that a nation's demographic structure, in particular the variation in the share of retirees or of their ratio to the share of workers (as proxies for the degree of inflation aversion), is a key driver of social preferences with regard to inflation. The results also highlight several other major long-run determinants of inflation aversion consistent with our model, namely, experience with past inflation and the collective memory embodied in institutions such as central bank independence or transmitted through the process of socialization. Our findings, thus, support the suggested theory, notably stressing how fundamental it is to understand the underlying trends in individuals' preferences and the mechanisms behind their intergenerational transmission.

The model we analyzed could be extended in several directions. On the theoretical side, allowing for population growth and/or higher heterogeneity of traits could provide valuable insights, as well as the examination of different processes guiding low-frequency inflation dynamics. On the empirical side, another implementation compatible with the theory we presented would be to consider how the evolution of the proportions of net savers and spenders in an economy can influence its degree of inflation aversion, provided data become available on a comparable cross-country basis.

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A Data Definitions and Sources

- **Degree of Inflation Aversion**
  - *Source:* International Social Survey Program (ISSP) on the role of government in society (Role of Government, wave IV) conducted by the Inter-university Consortium for Political and Social Research in 2006 for 33 participating countries.
  - *Definition:* authors' computations, summing up the percentage shares of responses falling in the first two categories of answers (*highlighted in Italics* among the enumerated below) to the following question (7b):
    - 'On the whole, do you think it should or should not be the government's responsibility to keep prices under control?'
    - the potential answers proposed to the respondents are:
      - '*definitely should be*';
      - '*probably should be*';
      - 'probably should not be';
      - 'definitely should not be';
      - 'can't choose';
      - 'no answer'.

- **Demography**
  - *Source:* World Bank, *World Development Indicators* (annual series by country: April 2008 and June 2009 issues, accessed via ESDS), for the year 2006; *except for Taiwan* (see below); World Bank staff estimates from various sources including census reports, the United Nations Population Division's World Population Prospects, national statistical offices, household surveys conducted by national agencies, and Macro International.
  - *Definitions:*
    - **population, total** (SP.POP.TOTL);
    - **share of retirees:** Population ages 65 or older (% of older, SP.POP.65UP.TO.ZS);
    - **share of working age population:** Population ages 15-64 (% of total, SP.POP.1564.TO.ZS).
  - *Source for Taiwan*: authors' computations of the above shares in the total population based on disaggregated data for the year 2000 by age groups from the National Statistics Republic of China (Taiwan); www.eng.stat.gov.tw.

- **Institutions**
  - *Sources:*
    - **central bank independence index:** from Arnone et al. (2009), for the year 2003; except for Taiwan: from Cukierman (1992), for the year 1989;
    - **property rights index:** from The Heritage Foundation, for the year 2009; www.heritage.org;
    - **high inflation dummy:** authors' coding in conformity with Fischer et al. (2002).
- **Macroeconomic Data**
  - *Source: Penn World Table Version 6.2* – see Heston et al. (2006); for the year 2004.
    - **population**;
    - **real GDP per capita**, in PPP-USD;
    - **real GDP**, in PPP-USD**:** authors' computations multiplying the above two numbers.

inflation aversion	mean	median	max	min	quant.	s. d.	skew.	kurt.	obs.
[60, 70)	0.674	0.674	0.674	0.674	0.674	–	–	–	1
[70, 80)	0.770	0.773	0.796	0.702	0.773	0.027	-1.96	5.83	9
[80, 90)	0.860	0.865	0.897	0.825	0.865	0.025	0.01	1.90	10
[90, 100)	0.946	0.937	0.980	0.910	0.937	0.023	0.07	1.54	13
all	0.864	0.870	0.980	0.674	0.870	0.083	-0.41	2.23	33

Table 1: Inflation Aversion: Descriptive Statistics by Quantile

Source: Authors' calculations based on ISSP 2006 RoG IV.

Regression	1	2	3	4
intercept	1.1030***	1.0418***	0.9104***	1.0159***
	(0.0000)	(0.0000)	(0.0042)	(0.0072)
retirees/workers	0.3154***	0.3376***	–	–
	(0.0022)	(0.0001)	–	–
retirees share	–	–	0.4849***	0.5114***
	–	–	(0.0002)	(0.0002)
workers share	–	–	0.2847	0.0466
	–	–	(0.5201)	(0.9355)
real GDP pc	$-2.98\cdot10^{-6}$*	$-5.35\cdot10^{-6}$**	$-3.78\cdot10^{-6}$*	$-5.31\cdot10^{-6}$**
	(0.0565)	(0.0162)	(0.0962)	(0.0141)
high inflation dummy	-0.0338***	0.0794	-0.0522**	0.0591
	(0.0010)	(0.1670)	(0.0247)	(0.5641)
CBI index	-0.1474***	-0.1105***	-0.1294**	-0.1099***
	(0.0058)	(0.0059)	(0.0135)	(0.0047)
property rights index	-0.1801*	-0.0437	-0.1602	-0.0528
	(0.0581)	(0.7372)	(0.1019)	(0.6412)
CBI × high inflation	–	-0.1775*	–	-0.1554
	–	(0.0614)	–	(0.2381)
adjusted R^2	0.9364	0.9443	0.9384	0.9420
F-statistic p-value	0.0000	0.0000	0.0000	0.0000

Table 2: Determinants of Inflation Aversion: Population-WLS Estimates

Note: Coefficients estimated by WLS using 2004 population weights from Heston et al. (2006) for:

$InflAvers_t = \alpha + \beta Retirees_t + \gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \epsilon_t$.

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

Regression	1	2	3	4
intercept	1.1332***	1.1272***	0.7873**	0.8015**
	(0.0000)	(0.0000)	(0.0353)	(0.1891)
retirees/workers	0.3564***	0.3650*	–	–
	(0.0080)	(0.0738)	–	–
retirees share	–	–	0.6462***	0.6522***
	–	–	(0.0048)	(0.0043)
workers share	–	–	0.4876	0.4603
	–	–	(0.3387)	(0.6345)
high inflation dummy	-0.0581	0.0054	-0.0830*	-0.0287
	(0.1498)	(0.9384)	(0.0708)	(0.7999)
CBI index	-0.1237***	-0.1185**	-0.1125**	-0.1087**
	(0.0100)	(0.0380)	(0.0203)	(0.0146)
property rights index	-0.3720***	-0.3713***	-0.3761***	-0.3755***
	(0.0000)	(0.0003)	(0.0000)	(0.0002)
CBI × high inflation	–	-0.1317**	–	-0.1105
	–	(0.0473)	–	(0.2622)
adjusted R^2	0.9048	0.9028	0.9057	0.9032
F-statistic p-value	0.0000	0.0000	0.0000	0.0000

Table 3: Determinants of Inflation Aversion: Real GDP-WLS Estimates

Note: Coefficients estimated by WLS using 2004 real GDP weights from Heston et al. (2006) for:

$InflAvers_t = \alpha + \beta Retirees_t + \gamma HighInflDum_t + \delta CBI_t + \eta PropRs_t + \epsilon_t$.

* denotes significance at the 10%, ** at the 5% and *** at the 1% level.

White correction for heteroskedasticity of unknown form applied.

inflation aversion									
ADVANCED ECONOMIES (17 COUNTRIES)									
European EMU (7)	FI	FR	DE	IE	NL	PT	ES		
mean: 0.857 (s.d.: 0.076)	0.786	0.828	0.783	0.930	0.796	0.963	0.910		
European non-EMU (5)	DK	NO	SE	CH	GB				
mean: 0.823 (s.d.: 0.053)	0.773	0.895	0.825	0.772	0.852				
non-European (5)	AU	CA	JP	NZ	US				
mean: 0.806 (s.d.: 0.088)	0.868	0.702	0.923	0.769	0.770				
EMERGING MARKETS (16 COUNTRIES)									
European (7)	HR	CZ	HU	LV	PO	RU	SI		
mean: 0.839 (s.d.: 0.094)	0.870	0.674	0.870	0.836	0.780	0.980	0.861		
non-European (9)	CL	DO	IL	KR	PH	ZA	TW	UY	VE
mean: 0.943 (s.d.: 0.026)	0.930	0.967	0.897	0.967	0.958	0.931	0.974	0.923	0.937

Table 4: Inflation Aversion: Descriptive Statistics by Country Groups

Source: Authors' calculations based on ISSP 2006 RoG IV. Country codes as in ISSP, namely: AU: Australia, CA: Canada, CH: Switzerland, CL: Chile, CZ: Czech Republic, DE: Germany, DK: Denmark, DO: Dominican Republic, ES: Spain, FI: Finland, FR: France, GB: Great Britain, HR: Croatia, HU: Hungary, IE: Ireland, IL: Israel, JP: Japan, KR: Korea, LV: Latvia, NL: Netherlands, NO: Norway, NZ: New Zealand, PH: Philippines, PO: Poland, PT: Portugal, RU: Russia, SE: Sweden, SI: Slovenia, TW: Taiwan, US: United States, UY: Uruguay, VE: Venezuela, ZA: South Africa.

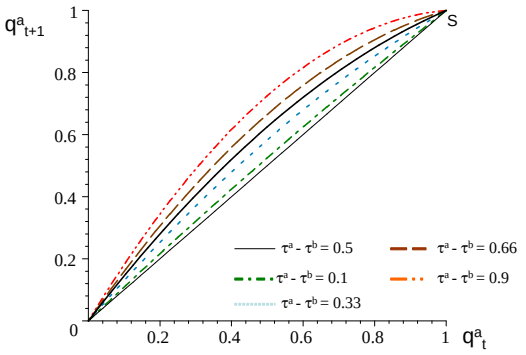

Figure 1: Deterministic Exogenous Convergence to Type-a Preferences

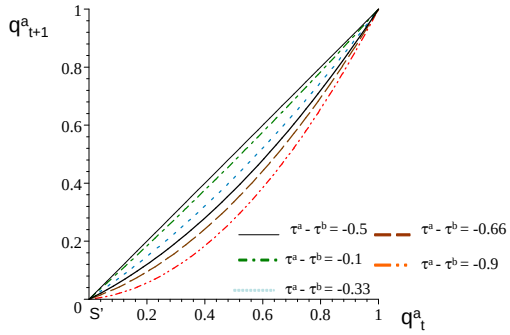

Figure 2: Deterministic Exogenous Convergence to Type-b Preferences

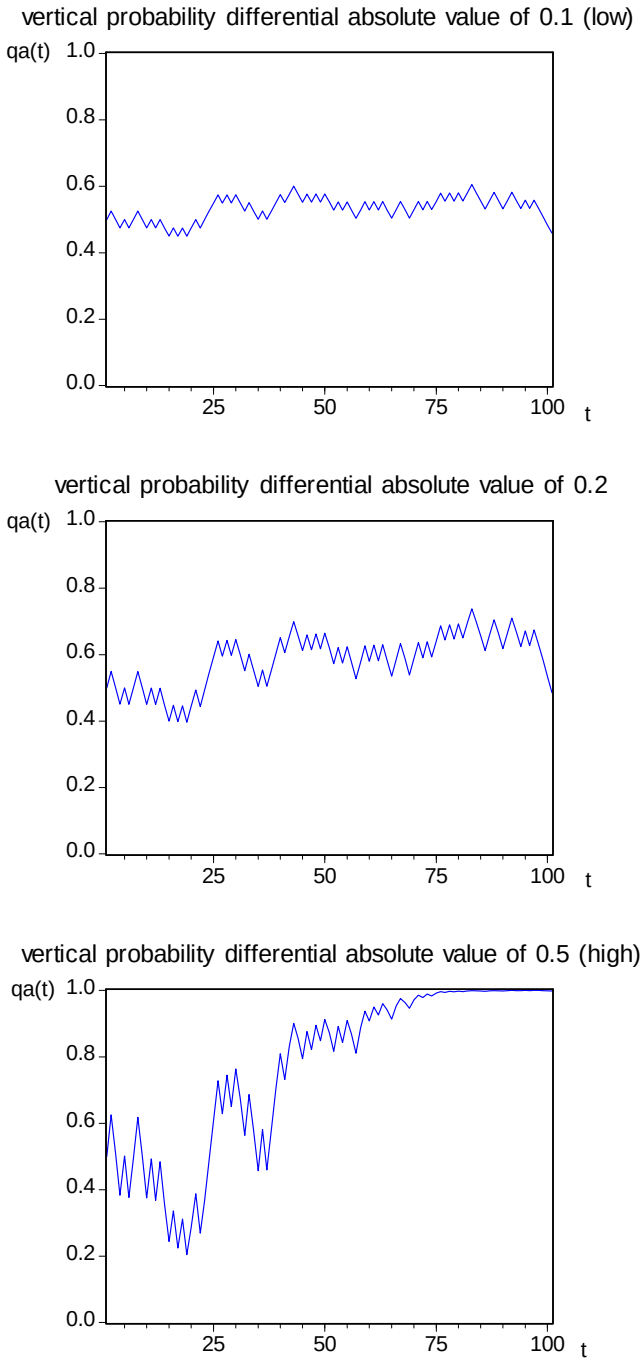

Figure 3: Stochastic Endogenous Dynamics of Type-a Preferences with Symmetric Socialization Effort Responding to Observed Inflation: Simulation Summary

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